

WE CLAIM:

1. A lens module for a thin scanning device, said lens module to be disposed on an optical path from an original to an image sensor, the optical path including a chief ray at zero-field propagating from a zero-field of the original to a zero-field of the image sensor, a chief ray at full-field propagating from a full-field of the original to a full-field of the image sensor, said lens module to be disposed between the original and the image sensor such that the chief ray at zero-field and the chief ray at full-field form an angle greater than 30 degrees therebetween at a side between said lens module and the image sensor, the optical path having a total length measured from the original to the image sensor, said lens module forming an object distance with the original, the total length being less than 1.5 times the object distance, an object height of the original when imaged on the image sensor being defined as an image height, the total length being less than five times the image height, said lens module comprising, in sequence from the original to the image sensor along the optical path:

a first lens having a focal length and a shape factor with identical signs, and disposed to form the object distance with the original;

a second lens having a focal length with a sign opposite to that of the focal length of said first lens,

and a shape factor with a sign opposite to that of the shape factor of said first lens;

5 a stop having a center and disposed such that the chief ray at zero-field and the chief ray at full-field pass through said center of said stop;

a third lens with a positive focal length and a positive shape factor;

a fourth lens with a positive focal length and a negative shape factor; and

10 a fifth lens with a negative focal length and a positive shape factor;

one of said first, second, third, fourth, and fifth lenses having a largest diameter and two opposite surfaces, said two opposite surfaces having curvature centers with identical signs;

15 a ratio of a diameter of said stop to that of said fifth lens being less than 0.5.

2. The lens module as claimed in Claim 1, wherein said first lens has a positive focal length and a positive shape factor, and said second lens has a negative focal length and a negative shape factor.

20 3. The lens module as claimed in Claim 1, wherein said first lens has a negative focal length and a negative shape factor, and said second lens has a positive focal length and a positive shape factor.

25 4. The lens module as claimed in Claim 1, wherein the ratio of the diameter of said stop to that of said fifth

lens ranges from 0.28 to 0.29.

5. A scanning device comprising:

a transparent window adapted for placement of an original;

5 a light source proximate to said transparent window;

an image sensor disposed to form an optical path with said transparent window, said optical path including a chief ray at zero-field propagating from a zero-field of the original to a zero-field of said image sensor,
10 a chief ray at full-field propagating from a full-field of the original to a full-field of said image sensor;
and

a lens module disposed between said transparent window and said image sensor such that the chief ray
15 at zero-field and the chief ray at full-field form an angle greater than 30 degrees therebetween at a side between said lens module and said image sensor;

said optical path having a total length measured from the original to said image sensor, said lens module
20 forming an object distance with the original, the total length being less than 1.5 times the object distance, an object height of the original when imaged on said image sensor being defined as an image height, the total length being less than five times the image height;

25 said lens module including, in sequence from said transparent window to said image sensor along said optical path:

a first lens having a focal length and a shape factor with identical signs, and disposed to form the object distance with the original;

5 a second lens having a focal length with a sign opposite to that of the focal length of said first lens, and a shape factor with a sign opposite to that of the shape factor of said first lens;

10 a stop having a center and disposed such that the chief ray at zero-field and the chief ray at full-field pass through said center of said stop;

a third lens with a positive focal length and a positive shape factor;

a fourth lens with a positive focal length and a negative shape factor; and

15 a fifth lens with a negative focal length and a positive shape factor;

20 one of said first, second, third, fourth, and fifth lenses having a largest diameter and two opposite surfaces, said two opposite surfaces having curvature centers with identical signs;

a ratio of a diameter of said stop to that of said fifth lens being less than 0.5.

25 6. The scanning device as claimed in Claim 5, further comprising a plurality of reflecting mirrors disposed between said transparent window and said image sensor for forming said optical path.

7. The scanning device as claimed in Claim 5, wherein

said first lens has a positive focal length and a positive shape factor, and said second lens has a negative focal length and a negative shape factor.

5 8. The scanning device as claimed in Claim 5, wherein said first lens has a negative focal length and a negative shape factor, and said second lens has a positive focal length and a positive shape factor.

9. The scanning device as claimed in Claim 5, wherein the ratio of the diameter of said stop to that of said
10 fifth lens ranges from 0.28 to 0.29.

10. The scanning device as claimed in Claim 5, wherein the angle formed between said chief ray at zero-field and said chief ray at full-field ranges from 36 to 37 degrees.

15 11. The scanning device as claimed in Claim 5, wherein the total length is from 1.22 to 1.46 times the object distance.

12. The scanning device as claimed in Claim 5, wherein the total length is 4.66 times the image height.